REMARKS

Applicants respectfully request reconsideration and allowance of all pending claims.

I. Status of the Claims

Upon entry of this amendment, claims 1-7, 17, and 65-73 remain pending. New claim 74 is added which finds its support, for example, in paragraph 0032.

The claims have been amended to address the Office's section 112 objections.

Applicants note that the previous rejections of claims 1-7, 17, and 65-69 over Barstad et al. (U.S. 6,444,110) in view of Creutz et al. (U.S. 4,110,176) have been withdrawn in view of Applicants' prior amendment. The new rejections in the present Office action use the same references, except now Creutz et al. is the primary reference and Barstad et al. is the secondary reference.

II. 35 U.S.C. §103(a) Rejection of Claims 1-7 and 65-71

Reconsideration is requested of the rejection of claims 1-7 and 65-71 as being obvious over Creutz et al. in view of Barstad et al.

Claim 1 includes the requirements of a particular semiconductor substrate, and a defect-reducing agent which is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine… which results in an increase in sulfur and chloride content in the deposit.

The basis for the rejection as stated on page 6 of the Office action is that Creutz et al. disclose all the elements of the claimed invention except the substrate, and that Barstad et al. cure this deficiency. In particular, the Office acknowledges Creutz et al. do not disclose any substrate which

is a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein, as recited in claim 1. But the Office asserts that in view of Barstad et al.,

> It would have been obvious to one having ordinary skill in the art at the time the invention was made ***to have modified the circuit device substrate described by Creutz with wherein the circuit device substrate is a semiconductor integrated circuit device substrate*** having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein because conventional copper plating systems would have been suitable for plating vias and trenches as small as 300 nm with 4:1 aspect ratios as taught by Barstad (col. 1, lines 36-65; col. 2, lines 20-25; col. 7, lines 56-65; and col. 8, Examples 1 and 2). (Emphasis added.)

The only electronic device substrates described by Creutz et al. are printed circuit boards (col. 2, ln. 23)("PCBs"). The Office is asserting that it would have been obvious to modify Creutz et al.'s PCB to be a semiconductor integrated circuit device substrate. Applicants respectfully take issue with this assertion and basis for the rejection. PCBs are resin-based, macro-scale carriers of electronic signals between electronic components. In contrast, semiconductor integrated circuit ("IC") device substrates comprise a semiconductor material -- e.g., "a silicon wafer having openings such as trenches and vias" (applicants' specification paragraph 0032) --; not a resin-based material. They are substrates for semiconductor-based miniaturized electronic components. By analogy, PCBs are an interstate highway system; whereas ICs are automobiles on that highway. These respective substrates are therefore

disparate in terms of material properties, character, and function.

Exhibit A accompanying this Amendment shows a PCB. The green resinous substrate is a PCB substrate with copper plating to form wiring interconnects. Deposition of copper to form this type of macro-wiring is what is contemplated in the Creutz et al. patent. The black rectangles are packaged IC devices. These, as broken open in Exhibit B, contain IC devices inside. These IC devices are prepared by slicing and dicing of segments from IC semiconductor substrates such as silicon wafers. Exhibit C is an example of a silicon wafer which is a "semiconductor IC substrate" of the type contemplated by the invention. Figs. 5 and 6 of the present application show a wafer segment in cross section at extremely high -- 120,000X -- magnification, which reveals features such as trenches and vias which are not visible in macrophotographs such as Exhibit C.

The proposition in the Office action -- that it would have been obvious to modify Creutz et al.'s substrate with a semiconductor IC substrate -- ignores the technical realities evident from the accompanying exhibits. The function of the green resinous PCB is to carry the black rectangle packaged IC devices and the various copper wiring visible to the eye in Exhibit A. The resinous PCB material is obviously selected for its various properties such as weight, density, workability, etc. which help it achieve its function of carrying packaged IC devices and associated copper wiring. In contrast, the semiconductor IC substrate material serves a wholly distinct function. It is manufactured to contain submicron size vias and other circuitry, and to perform the various logic and memory functions assigned to the individual device. It (in the form shown in Exhibit C) is processed according to the invention, then sliced and diced into individual units, then packaged in

* the black rectangular plastic packaging of Exhibit B, then
* attached to the PCB substrate as shown in Exhibit A.

In view of the disparate purposes of a PCB substrate such as contemplated by Creutz et al. and the semiconductor integrated circuit substrate of claim 1, as well as their disparate properties and functions, applicants' respectfully submit that it cannot fairly be deemed to have been obvious to "have modified the circuit device substrate described by Creutz with wherein the circuit device substrate is a semiconductor integrated circuit device substrate having electrical interconnect features ..." as asserted in the Office action.

The proposed modification is also not obvious because, as emphasized in MPEP 2143.01(V), a proposed modification is not obvious if it renders the prior art unsatisfactory for its intended purpose. Semiconductor integrated circuit substrates do not have the flexibility, workability, or density of resinous PCB substrates, and therefore are unsatisfactory for the intended purpose of PCBs.

Moreover, for a proposed combination to be obvious, there must be some reasonable expectation of success, per MPEP 2143.02. The various properties of semiconductor integrated circuit substrates -- e.g., silicon wafers -- are so distinct from the properties of PCB substrates -- e.g., epoxy-based resins -- that there is no reasonable technical basis to conclude the proposed modification would be successful.

Claim 1 and the claims dependent therefrom are therefore patentable over Creutz t al. in view of Barstad et al. because it would not have been obvious to modify Creutz et al.'s PCB

substrate to be a semiconductor IC substrate of the type disclosed by Barstad et al.[1]

These claims are also patentable because even if the modification were made, the combination of references does not disclose or suggest the express requirement to increase the overall chloride content and the overall sulfur content of the copper deposit. In particular, neither Barstad et al. nor Creutz et al. discuss problems related to creep deformation or the advantages which could be gained from purposefully introducing chloride impurity in the copper deposit. It is not surprising that Creutz et al., directed to plating through holes in PCB substrates, do not discuss the problem because creep deformation is not a serious problem in copper in through holes in PCB substrates. Moreover, they state that chlorine concentration in the bath should be kept low:

> "Although it has been found to be desirable that chlorine and/or bromide anions in the bath are below about 0.1 gram per liter, appreciably greater amounts of many inorganic cations , such as ferrous iron, nickel, cobalt, zinc, cadmium, and the like, may be present in the bath …."

Similarly, Barstad et al. are silent, or even in some respects teach away from including a component in their copper electroplating bath which purposefully introduces impurities in the copper deposit where they express a preference for plating copper which has an absence of "…voids, ***inclusions***, and seams)…" See Col. 2, lines 36-42 of Barstad et al.

Moreover, while it may be tempting to conclude that the proposed combination of Creutz et al. and Barstad et al. would have *inherently* increased the chloride and sulfur content of the

[1] The mirror-image modification -- modification of Barstad's chemistry to include Creutz's brightener -- would not have been obvious for the reasons stated in the prior Amendment in response to the now-withdrawn rejection where Barstad et al. was the primary reference.

deposit, this cannot fairly be maintained in view of the disparate nature of the respective teachings as to how the particular reaction product is used. In particular, Creutz et al. added the reaction product in a quantity of just 0.5 mg/L (Example II, col. 6, line 12). Examples III and IV used only 1 and 0.4 ppm of the reaction product. There is no indication this would increase the chloride and sulfur content of the deposit as required by claim 1.

For a property to be deemed to be inherent, the Office must establish by fact or technical reasoning why it is *necessary* that the Creutz + Barstad combination would inherently increase chloride and sulfur content in the deposit as in claim 1:

> Inherency, however, *may not be established by probabilities or possibilities*. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. (MPEP 2112 (quoting In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999)))(emphasis added).
>
> In relying on the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teaching of the applied prior art. (MPEP 2112 (citing Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)))(emphasis added).

In the present situation there is no technical basis to make this conclusion in view of the lack of any statement by Creutz et al. that they increased chloride content and in view of the low quantities in which the reaction product was added.

Claims 2-7 and 65-71 depend from claim 1 and are patentable for the same reasons and by virtue of the additional requirements they contain.

III. 35 U.S.C. §103(a) Rejection of Claims 17 and 72-73

Reconsideration is requested of the rejection of claims 17 and 72-73 as being obvious over Creutz et al. (U.S. 4,110,176) in view of Barstad et al. (U.S. 6,444,110).

These claims include the same requirements as claim 1 and are therefore patentable for the same reasons as claim 1 is patentable.

CONCLUSION

A check in the amount of $1,020.00 is enclosed for payment of the three-month extension of time fee. The Commissioner is authorized to charge any underpayment or credit any overpayment to Deposit Account No. 19-1345.

In view of the foregoing, applicants request reconsideration and allowance of all pending claims.

Respectfully submitted,

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*Attachments

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